PRELIMINARY EVALUATION OF CHEMICAL COMPOSITION OF DUCK'S MUSCLES FROM TWO POLISH CONSERVATIVE FLOCKS

Wołoszyn J.[1], Książkiewicz J.[2],Orkusz A.[1], Skrabka- Błotnicka T.[1], Biernat J.[3], Kisiel T[2].
[1]University of Economics, Wrocław, Poland
[2] National Research Institute of Animal Production, Department of Waterfowl Breeding, Dworzyska/ Poznań
[3] Medical University, Department of Food Science and Nutrition, Wrocław, Poland

Background

The conservation of domestic animal diversity (DAD), including poultry, is justified for biological, economic and even cultural and historic reasons (Crawford 1993, Wężyk 1990). An inventory of world's poultry genetic resources was initiated under auspices of FAO (Wężyk et al. 1995) to protect animals living in the nature as well as breeds, lines and varieties developed by man and threatened with extinction. In Poland the idea of conservation of duck genetic resources and their protection against extinction dates back to the early 1970-ies. From the breeding point of view, the maintenance of genetically diversified bird groups is necessary to cause genetic variability in the selected populations. In ducks those groups were used in the development of new breeding and experimental strains and synthetic groups as well as in the search for heterosis effects in commercial sets (Książkiewicz 1997, Pruszyńska et al. 2001). Therefore, the purpose of this study was evaluation of chemical composition of duck's muscles from two Polish conservative flocks.

Objectives

To study the chemical composition of breast and leg muscles from two Polish conservative duck flocks (P33 and K2). The chemical composition includes the content of : proteins, lipids, moisture, amino acids, fatty acids and cholesterol.

Methods

The material for examination were two conservative groups of ducks maintained *in situ* method in the Department of Waterfowl Breeding Dworzyska near Poznań. It was used : 1) the Mini- ducks (K2), bred from wild ducks (Anas platyrhynchos L.) and Pekin ducks (FAO 2000); 2) Polish Pekin (P33), native breeding strain taken from the farm at Borowy Młyn (FAO 2000). Breast's and leg's muscles used for analysis
(12 breast- B and leg- L muscles) were taken from six 7-week old drakes from each duck's group (having body weight closed to the arithmetic mean of sex in the given group). The content of moisture, proteins, and lipids was determined with standard methods (A.O.A.C., 1990). The cholesterol content was determined by the enzymatic test. The amino acids composition was carried out using MIKROTECHMA Amino Quant the AAA T 339 type. The acid hydrolysis was carried out with 6N HCl. Tryptophan was determined from the alkaline hydrolyzate (with 4 N LiOH). The fatty acids composition was carried out using the gas chromatography. The Agilent Tech. 6890N Chromatograph was used. The methyl esters of fatty acids were separated on the CP-Sil 88 (Chrompack) capillary column (100 x 0.25 mm). Helium was used as the carrier gas. The separation was conducted at the programmed temperature from 165 to 200°C by increase rate at 2°C/min.

Results and Disscusion

The results are shown in tables 1-4. The higher content of lipids was in leg (1.40-1.73%) muscles than in breast (0.8-1.16%) muscles derived from both duck's groups (table 1). Duck's muscles were characterized by lower level of lipids in comparison with other kinds of ducks. In previous studies was stated that the breast and leg muscles from different lines of Pekin ducks consisted of 1.6-3% (breast) and 1.7-7% (leg) lipids (Skrabka- Błotnicka 1986, Smith et al. 1993, Knust 1995, Górska and Górski 1997). It seems that these differences might be a consequence of various origin of ducks. There were no differences in the moisture and protein contents in investigated muscles. These values were typical for duck meat. Content of cholesterol was higher (95.17-112.22mg%) than in muscles of other breeds (67-99mg%) of ducks (Wołoszyn et al. 1995, Salichon et al. 1993, Honikel and Arneth 1996). No significant differences were found in the cholesterol content in breast and leg muscles from both groups of ducks. Composition of amino acids in muscles of both group of ducks was similar (table 2). The isoleucine and valine were amino acids which limited the biological value of protein (table 3). Except both of them, the meat proteins contained more exogenic amino acids than the FAO standard. The unsaturated fatty (UFA) acids were predominant in fatty acids composition of lipids from muscles of both kinds of ducks (table 4). The monounsaturated fatty acids (MUFA) amounted to 23.46- 30.75% and polyunsaturated (PUFA) to 25.97- 30.44% of the global content of fatty acids. This is agreed with results previously published by Salichon et al. (1993), Romboli et al. (1997) for Muscovy and Smith et al. (1993), Leskanich and Noble (1997) for Pekin ducks. The leg muscles were characterized by higher level of MUFA than breast muscles of both strains of duck flocks. The highest content of oleic and palmitic acids among the identified fatty acids were stated, too. The unsaturated/ saturated (UFA/ SFA) ratio was higher (1.62-1.86) for leg muscles than for breast (1.19-1.401) ones.

Conclusion

The duck muscles from two conservative Polish flocks were characterized by similar chemical composition. The basic chemical composition, the low level of lipids, high content of unsaturated fatty acids especially oleic acid and higher level of exogenic amino acids (except leucine and valine) testified, that the investigated muscles are favourable from the human nutrition point of view.

Pertinent literature

A.O. A.C. (1990). „ Official Methods Analysis" 15th ed. Assosiation of Official Analytical Chemists. Washington, D.C.
Crawford R.D. (1993). Gene resources : global view of inventory and conservation. Proc. 10th Int. Symp. Nitra, Slovakia, 131-136.
Górska A., Górski J. (1997). The change of the total protein, collagen and fat content in Pekin duck crossbreds at the end of rearing period. Proc.13th European Symposium on the Quality of Poultry Meat. Poznań 1997, 334-337.

Honikel K.O., Arneth W. (1996). Cholesterol in meat and eggs. Cholesteringehalt in Fleisch and Eiren. Fleischwirtschaft, (12), 1244, 1246-1248, 1253, 1329

Knust U. (1995). Untersuchungen zur Charakterisierung der Wirkung von prä - and postmortalen Faktoren auf die Schlachtkörperzusammensetzung, die Muskel- faserzusammensetzung und die Fleischqualität von Enten. Diss., Universität Halle 1995.

Książkiewicz J. (1997). Characteristics of meatness traits in six generations of ducks in conservative groups. J Anim. Feed Sci 1,6, 101-108.

Leskanich C.O., Noble R.C. (1997). Manipulation of the n-3 PUFA composition of avian eggs and meat. World's Poultry Sci. J., 53, 156-183.

Pruszyńska E., Książkiewicz J., Nogowski L. (2001). Relationships between blood serum parameters and selected carcass characteristics of Pekin type ducks from conservative flocks. Ann. Anim. Sci. 1,2, 53-62.

Romboli I., Russo C., Zanobini S. (1997). Effect of dietary vitamin E on chemical composition and meat colour in heat stressed muscovy duck. Proc.13th European Symposium on the Quality of Poultry Meat. Poznań 1997, 205-211.

Salichon R. M., Leclercq B., Remignon G., Marche G., Blum I.C. (1993). Composition biochimique des filets de canard de barbarie. Proc. 11-th European Symposium on the Quality of Poultry Meat. Tours 1993, 368-371.

Skrabka-Błotnicka T. (1986). Właściwości emulgujące i żelujące białek i mięśni drobiowych ze szczególnym uwzględnieniem drobiu wodnego. Prace Naukowe AE., Wrocław 1986. Z. 358

Smith D.P., Fletcher D.L., Buhr R.J., Beyer D.S. (1993). Pekin duckling and broiler pectoralis muscle structure and composition. Poultry Sci., 72, 202-208.

Wężyk S. (1990).Programes for preservation of livestock breeds in Eastern Europe, Animal genetic, resources. FAO Animal Production and Halth Paper, Rome, 80.

Wężyk S., Cywa- Benko K., Romanov N.M. (1995). Protection against the extinction of the native breeds of poultry in Eastern European countries, Proc. Int. Symp. on Conservation Measures for Rare Farm Animal Breeds, Balice, May 17-19, 89-101.

Wołoszyn J., Skrabka-Błotnicka T., Przysiężna E. (1995). The quality characteristic of force fattened duck carcasses. Proc.12th European Symposium on the Quality of Poultry Meat. Zaragoza 1995, 177-188.

World Watch List, for domestic animal diversity, 3rd edition FAO, Rome (2000).

Acknowledgements

Table: 1. The chemical composition of breast (B) and leg (L) duck muscles

PARAMETER	P33-B	K2-B	P33-L	K2-L
protein [%]	20.25	20.91	20.64	20.55
lipids [%]	0.80	1.16	1.73	1.40
moisture [%]	77.70	76.67	77.21	76.49
cholesterol [mg%]	95.17	106.05	111.82	112.22

Table: 4. Fatty acids of lipids from duck muscles

% of the global content of fatty acids	P33-B	K2-B	P33-L	K2-L
Σ saturated fatty acids (SFA)	42.04	38.84	34.89	32.51
Σ monounsaturated fatty acids (MUFA)	23.46	24.01	30.75	30.49
Σ polyunsaturated fatty acids (PUFA)	26.66	30.44	25.97	30.13
UFA/ SFA	1.19	1.40	1.62	1.86

Table: 2 . The amino acids composition of duck muscles

Amino acid	P33-B	K2-B	P33-L	K2-L
ASX	9.17	8.50	8.78	8.89
THR	4.06	4.15	4.22	4.33
SER	3.70	3.81	3.93	3.98
GLX	17.69	17.95	18.75	18.93
PRO	4.30	3.86	4.28	4.39
CYS	0.96	0.88	0.93	1.02
GLY	3.87	3.92	4.04	4.04
ALA	5.71	5.94	5.96	5.97
VAL	3.63	3.74	3.66	3.82
MET	2.26	2.32	2.35	2.34
ILE	3.21	3.24	3.26	3.29
LEU	7.58	7.88	7.69	7.89
TYR	3.10	3.27	3.33	3.57
PHE	2.84	3.04	2.94	3.27
HIS	2.57	3.35	3.10	3.42
LYS	8.76	8.68	9.03	9.04
ARG	7.06	7.13	7.31	7.18
TRP	1.13	1.15	1.09	1.20

Table: 3. The vales of the exogenic amino acids coefficient

Amino acid	P33-B	K2-B	P33-L	K2-L
Phe + Tyr	99.0	105.0	104.5	114.0
Ile	81.7	81.0	81.5	82.3
Leu	108.3	112.6	109.8	112.7
Lys	159.2	157.8	164.2	164.4
Met + Cys	92.0	90.0	93.7	96.0
Thr	101.5	103.8	105.5	108.3
Trp	113.0	115.0	109.0	120.0
Val	72.6	74.8	73.2	76.4